

Appl. No. : 09/855,321
Filed : May 14, 2001

REMARKS

Claims 17-21 and 23-45 are pending in this Application and were rejected in a non-final Office Action sent electronically on February 21, 2007. In the present Amendment and Response to Office Action, Applicants have amended Claims 17 and 38-39. Applicants respectfully request entry of the amendments and full consideration of the remarks contained herein.

Amendments to the Claims

Applicants have amended the claims to further clarify the subject matter that Applicants regard as the invention. For example, independent Claim 17 has been amended to recite “determining a volume of the reaction space, wherein X is equal to the volume of the reaction space; determining an inactive gas volume of at least 2X; and moving the inactive gas volume of at least 2X through the reaction space.” Support for this language can be found in the Application, *e.g.*, p. 8, as originally filed. In addition, Applicants have amended Claims 17 and 38-39 to correct and obvious clerical errors. Claim 17 has been amended to add a colon after the phrase “the method comprising” and periods have been added at the ends of Claims 38-39.

Applicants respectfully submit that the amendments add no new matter and are fully supported by the application as originally filed.

Rejections Under 35 U.S.C. §§ 102 and 103

Independent Claims 17 and 41 have been rejected as being anticipated by U.S. Patent No. 5,300,186 (“Kitahara”), or, alternatively, as being obvious in view of Kitahara. Dependents of Claims 17 and 41 have been rejected as being anticipated by Kitahara and/or as being obvious in view of Kitahara alone and/or Kitahara in combination with U.S. Patent No. 3,662,583 (“Moore”). Among other things, the Examiner has asserted that Kitahara necessarily teaches moving multiple reaction space volumes of inactive gas through the reaction volume between reactant pulses, and, even if Kitahara does not necessarily provide this teaching, the skilled artisan would arrive at this teaching as a matter of routine experimentation to reduce contamination.

Applicants respectfully traverse the rejections and submit that the claims, as amended, distinguish the art of record.

I. The Art of Record, Including Kitahara, Does Not Teach All Limitations of the Pending Claims

A. The Art of Record Does Not Teach All Limitations of Amended Claim 17

Applicants note that amended Claim 17 recites a particular methodology for flowing inactive gases into a reaction space. Claim 17 recites “determining a volume of the reaction space, wherein X is equal to the volume of the reaction space; determining an inactive gas volume of at least 2X; and moving the inactive gas volume of at least 2X through the reaction space.” Thus, once the volume of the reaction space is determined (identified as “X”), the inactive gas flow through the reaction space can be determined based upon this volume, with the total volume of the inactive gas set at “at least 2X.” Applicants have discovered that reaction space volume is a variable which should be used to determine the quantity of inactive gas flowed between reactant pulses.

Applicants submit that even assuming, for argument, that Kitahara teaches all that has been asserted and that Kitahara describes conditions which, by coincidence, result in a 2X volume of inactive gas flowing through its reaction space, Kitahara does not teach a process in which the variable of reaction space volume (“X”) is expressly and purposefully used to determine the volume of inactive gas to flow through a reaction space. Kitahara does not recognize the significance of reaction space volume for determining inactive gas flows. Rather, as noted by the Examiner, the prejudice in the art was to determine inactive gas flows based upon purge times and considerations of throughput and processing speed. Kitahara simply does not utilize a determination of reaction space volume to calculate the inactive gas flow, as Applicants have taught. Thus, Applicants submit that Kitahara does not teach the steps of “determining a volume of the reaction space, wherein X is equal to the volume of the reaction space; determining an inactive gas volume of at least 2X; and moving the inactive gas volume of at least 2X through the reaction space.” The art of record does not satisfy Kitahara’s deficiencies. As a result, Applicants respectfully submit that the art of record, including Kitahara, does not render obvious Claim 17 or its dependents.

B. The Art of Record Does Not Disclose or Suggest the Gas Flow Inlets and Sequence of Gas Flows Recited in Independent Claim 41

Applicants note that Kitahara discloses flowing all gases, whether reactants or inactive gases, through a single gas mixer 26. *See, e.g.*, Kitahara, Figure 1 and Col. 4, lines 38-39.

In contrast, Claim 41 recites flowing first and second reactants into a reaction chamber through *separate* openings. Moreover, Claim 41 recites a particular sequence for the flows. In a first pulse “only an inactive gas [is flowed] through a *second* inflow channel while flowing the first vapor-phase reactant through the *first* inflow channel” and then “in a second pulse, flowing only an inactive gas through the *first* inflow channel while the second vapor-phase reactant flows through the *second* inflow channel.” (emphasis added). Each of these inflow channels specifically opens directly into the reaction chamber. Thus, Claim 41 specifies that a flow of “only” inactive gas into the process chamber, alternates between the gas flow channels and alternates depending upon whether a reactant is flowing through the channel.

Advantageously, these channels and this flow sequence address problems with reactivity between the reactants and contamination in the piping system which delivers the reactants. For example, Applicants have found that, in the often long and complex path of a reactant through a piping system, the reactant may persist in pockets in the piping system. When another reactant is flowed through the same piping, undesired reactions may occur. To guard against such reactions, Applicants have devised a reactant delivery system with multiple dedicated channels for the reactants. For example, as recited in Claim 41, “first” and “second” inflow channels are provided. Applicants submit that Kitahara does not teach or suggest such “first” and “second” inflow channels, much less the need or desire to purge with the amount of inactive gas recited for this type of arrangement.

Moreover, Applicants have found that undesired back flow of reactant from one reactant inflow channel into another a reactant inflow channel can also cause undesired contamination. As recited in Claim 41, Applicants have advantageously addresses this problem by flowing inactive gas through the channel that is not delivering reactant into the process chamber. As a result of this flow, reactant flowing out of one inflow channel is prevented from flowing into another inflow channel. Applicants submit that Kitahara also does not teach or suggest “in a first pulse, flowing only an inactive gas through a *second* inflow channel while flowing the first

vapor-phase reactant through the *first* inflow channel” and then “in a second pulse, flowing only an inactive gas through the *first* inflow channel while the second vapor-phase reactant flows through the *second* inflow channel,” as recited by Claim 41. (emphasis added). As such, Applicants submit that Claim 41 and its dependents are not anticipated by or obvious in view of Kitahara.

II. Applicants Do Not Acquiesce in Other Assertions Made By the Examiner

Applicants submit that the discussion above is sufficient to overcome the rejections of all pending claims. Nevertheless, Applicants note for the record that Applicants do not acquiesce in the assertions made by the Examiner. Some of those assertions are discussed below.

A. Kitahara Does Not Inherently Teach “moving a volume of at least 2X through the reaction space,” As Recited by Independent Claims 17 and 41

The Examiner has asserted that Kitahara necessarily teaches moving at least a 2X volume of inactive gas through its reaction chamber because: 1) Kitahara teaches flowing 2 SLM of hydrogen into a reaction chamber for 3 seconds at a chamber pressure of 20 Torr; and 2) Kitahara’s Figure 3 teaches that more than this amount of gas is used during Kitahara’s purge step.

Initially, regarding Figure 3, Applicants note that this figure provides no indication that the elements of its graph correspond to precise proportions or numerical values. Indeed, Figure 3’s axes are not labeled with any units and Kitahara’s specification does not state that Figure 3 is drawn to scale. As such, Applicants note that Figure 3 cannot be used to establish particular values for time and flow rates. *See* M.P.E.P. §2125 (stating that patent drawings do not define the precise proportions of the elements in the drawings unless the specification teaches otherwise).

Regarding the hydrogen flow noted by the Examiner, the Examiner has asserted that Kitahara teaches flowing a particular amount of hydrogen gas into its reaction chamber. The Examiner also appears to have asserted that this amount of hydrogen gas can fill multiple reaction space volumes, since gas can expand to fill a volume. As a result, the Examiner appears to assert that the hydrogen gas flow of Kitahara *necessarily* meets the limitation of being

multiple reaction space volumes, because that gas has the ability to fill multiple reaction space volumes.

Kitahara, however, does not teach that its hydrogen gas volume can be any volume. Applicants emphasize that, as recognized by the Examiner, gas pressure and the volume occupied by the hydrogen gas are inversely related.¹ Kitahara teaches delivering a particular quantity of gas, for a particular duration, to its reaction chamber, which is at a particular temperature. Moreover, Kitahara teaches using a pressure of 20 Torr. Given these constraints of gas quantity, pressure and temperature, Applicants note that the volume of gas of Kitahara cannot be said to be “any” volume. For example, the skilled artisan will understand that the gas pressure will decrease if the reaction space volume increases from a baseline volume. However, such a change in gas pressure would be against the express teachings of Kitahara that its gas pressure be 20 Torr. Consequently, the Examiner’s assertion that the ability of gas to expand to *any* reasonable volume necessarily makes Kitahara’s hydrogen gas flow at least two reaction space volumes is not supported by Kitahara, because Kitahara teaches a particular set of process conditions, including pressure, which limits the volume occupied by the gas.

How this gas volume compares to the volume of Kitahara’s reaction space is unclear, however, since Kitahara does not disclose the volume of its reaction space. Consequently, depending on the reaction space volume, there is a possibility that the volume occupied by the gas is more than two reaction space volumes, but there is also a possibility that the volume occupied by the gas is less than two reaction space volumes. Given these differing possibilities, it cannot be said that Kitahara *inherently* teaches “moving a volume of at least 2X of inactive gas through the reaction space,” as recited by independent Claims 17 and 41. *See* M.P.E.P. § 2131.01(III) (quoting *Continental Can Co. USA*, 20 U.S.P.Q.2d at 1749) (to establish inherency, the art of record “must make clear that the missing descriptive matter is *necessarily* present in the thing described in the reference”) (emphasis added). Because Kitahara does not necessarily and,

¹ For example, as well-known by the skill artisan, the relationship between pressure and volume for an ideal gas is given by the following equation:

$$PV = nRT,$$

where P is pressure
V is volume
n is number of moles of the gas
R is the universal or ideal gas constant
T is temperature.

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as a result, does not inherently, teach a hydrogen flow which moves an inactive gas volume of “at least 2X” through the reaction space, as recited by independent Claims 17 and 41, Applicants submit that Kitahara does not anticipate independent Claims 17, 41 or their dependents.

Accordingly, Applicants respectfully submit that the pending claims are allowable over the art of record. Furthermore, any remarks in support of patentability of one claim should not be imputed to any other claim, and any remarks based on a portion of a claim should not be taken as founding patentability on that portion. Rather, it is intended that patentability rests on the claim as a whole. Furthermore, any such remarks which do not quote the claim portion verbatim should not be used to vary the meaning of the claim, as such are intended as a convenience to improve readability. If not specifically addressed herein, Applicants respectfully traverses each of the Examiner’s rejections and assertions as to what the prior art shows or teaches, alone or in combination.

Moreover, although the present communication includes alterations to the application or claims, or characterizations of claim scope or referenced art, the Applicants are not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. The Applicants reserve the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that the Applicants have made any disclaimers or disavowals of any subject matter supported by the present application.

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CONCLUSIONS

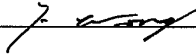
In view of the foregoing, Applicant submits that the application is in condition for allowance and respectfully request the same. If any issue remains which the Examiner feels may be addressed by Examiner's amendment, the Examiner is cordially invited to call the undersigned for authorization.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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